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TRANSMITTAL FORM

(to be used for all correspondence after initial filing)

Application Number	10/689,232
Filing Date	October 20, 2003
First Named Inventor	Alan A. Gilmore
Art Unit	2837
Examiner Name	Rina I. Duda
Attorney Docket Number	0275D-113COE
Total Number of Pages in This Submission	

ENCLOSURES *(check all that apply)*

- [x] Fee Transmittal Form
  - [ ] Fee Attached
- [ ] Amendment / Reply
  - [ ] After Final
  - [ ] Affidavits/declaration(s)
- [ ] Extension of Time Request
- [ ] Express Abandonment Request
- [ ] Information Disclosure Statement
- [ ] Certified Copy of Priority Document(s)
- [ ] Response to Missing Parts/ Incomplete Application
  - [ ] Response to Missing Parts under 37 CFR 1.52 or 1.53
- [ ] Drawing(s)
- [ ] Licensing-related Papers
- [ ] Petition
- [ ] Petition to Convert to a Provisional Application
- [ ] Power of Attorney, Revocation Change of Correspondence Address
- [ ] Terminal Disclaimer
- [ ] Request for Refund
- [ ] CD, Number of CD(s) _____
- [ ] After Allowance Communication to Technology Center (TC)
- [ ] Appeal Communication to Board of Appeals and Interferences
- [x] Appeal Communication to TC **(Appeal Notice, Brief, Reply Brief)**
- [ ] Proprietary Information
- [ ] Status Letter
- [ ] Other Enclosure(s) *(please identify below)*:

Remarks

The Commissioner is hereby authorized to charge any additional fees that may be required under 37 CFR 1.16 or 1.17 to Deposit Account No. 02-2548. A duplicate copy of this sheet is enclosed.

SIGNATURE OF APPLICANT, ATTORNEY, OR AGENT

Firm *or* Individual name	Harness, Dickey & Pierce, P.L.C.	Attorney Name Christopher M. Brock	Reg. No. 27313
Signature	Christopher M. Brock		
Date	August 8, 2005		

CERTIFICATE OF TRANSMISSION/MAILING

I hereby certify that this correspondence is being facsimile transmitted to the USPTO or deposited with the United States Postal Service with sufficient postage as first class mail in an envelope addressed to: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450 on the date shown below.

Typed or printed name	Christopher M. Brock	Express Mail Label No.	EV 406 075 921 US (8/8/2005)
Signature	Christopher M. Brock	Date	August 8, 2005

EV 406 075 921 US

PTO/SB/17 (10-04v2)
Approved for use through 07/31/2006. OMB 0651-0032
U.S. Patent and Trademark Office: U.S. DEPARTMENT OF COMMERCE

FEE TRANSMITTAL for FY 2005

Effective 10/01/2004. Patent fees are subject to annual revision.

☐ Applicant claims small entity status. See 37 CFR 1.27

TOTAL AMOUNT OF PAYMENT ($) 500

Complete if Known	
Application Number	10/689,232
Filing Date	October 20, 2003
First Named Inventor	Alan A. Gilmore
Examiner Name	Rina I. Duda
Art Unit	2837
Attorney Docket No.	0275D-113/COE

METHOD OF PAYMENT (*check all that apply*)

☐ Check ☐ Credit card ☐ Money Order ☐ Other ☐ None

☒ Deposit Account:

Deposit Account Number: 02-2548

Deposit Account Name: Black & Decker (U.S.) Inc.

The Director is authorized to: (*check all that apply*)
☒ Charge fee(s) indicated below ☒ Credit any overpayments
☒ Charge any additional fee(s) or any underpayment of fees under 37 CFR 1.16 and 1.17
☐ Charge fee(s) indicated below, **except for the filing fee**
to the above-identified deposit account.

FEE CALCULATION

1. BASIC FILING FEE

Large Entity Fee Code	Large Entity Fee ($)	Small Entity Fee Code	Small Entity Fee ($)	Fee Description	Fee Paid
1001	790	2001	395	Utility filing fee	
1002	350	2002	175	Design filing fee	
1003	550	2003	275	Plant filing fee	
1004	790	2004	395	Reissue filing fee	
1005	160	2005	80	Provisional filling fee	

SUBTOTAL (1) ($) 0

2. EXTRA CLAIM FEES FOR UTILITY AND REISSUE

			Extra Claims		Fee from below		Fee Paid
Total Claims		-20 ** =	0	X		=	0
Independent Claims		-3 ** =	0	X		=	0
Multiple Dependent				X		=	0

Large Entity Fee Code	Large Entity Fee ($)	Small Entity Fee Code	Small Entity Fee ($)	Fee Description
1202	50	2202	25	Claims in excess of 20
1201	200	2201	100	Independent claims in excess of 3
1203	360	2203	180	Multiple dependent claim, if not paid
1204	200	2204	100	** Reissue independent claims over original patent
1205	50	2205	25	** Reissue claims in excess of 20 and over original patent

SUBTOTAL (2) ($) 0

***or number previously paid, if greater; For Reissues, see above*

FEE CALCULATION (continued)

3. ADDITIONAL FEES

Large Entity Fee Code	Large Entity Fee ($)	Small Entity Fee Code	Small Entity Fee ($)	Fee Description	Fee Paid
1051	130	2051	65	Surcharge - late filing fee or oath	
1052	50	2052	25	Surcharge - late provisional filing fee or cover sheet.	
1053	130	1053	130	Non-English specification	
1812	2,520	1812	2,520	For filing a request for *ex parte re*examination	
1804	920*	1804	920*	Requesting publication of SIR prior to Examiner action	
1805	1,840*	1805	1,840*	Requesting publication of SIR after Examiner action	
1251	120	2251	60	Extension for reply within first month	
1252	450	2252	225	Extension for reply within second month	
1253	1020	2253	510	Extension for reply within third month	
1254	1590	2254	795	Extension for reply within fourth month	
1255	2160	2255	1080	Extension for reply within fifth month	
1401	500	2401	250	Notice of Appeal	
1402	500	2402	250	Filing a brief in support of an appeal	500
1403	1000	2403	500	Request for oral hearing	
1451	1,510	1451	1,510	Petition to institute a public use proceeding	
1452	500	2452	250	Petition to revive – unavoidable	
1453	1500	2453	750	Petition to revive – unintentional	
1501	1400	2501	700	Utility issue fee (or reissue)	
1502	800	2502	400	Design issue fee	
1503	1100	2503	550	Plant issue fee	
1460	130	1460	130	Petitions to the Commissioner	
1807	50	1807	50	Processing fee under 37 CFR 1.17 (q)	
1806	180	1806	180	Submission of Information Disclosure Stmt	
8021	40	8021	40	Recording each patent assignment per property (times number of properties)	
1809	790	2809	395	Filing a submission after final rejection (37 CFR § 1.129(a))	
1810	790	2810	395	For each additional invention to be examined (37 CFR § 1.129(b))	
1801	790	2801	395	Request for Continued Examination (RCE)	
1802	900	1802	900	Request for expedited examination of a design application	

Other fee (specify) ____

*Reduced by Basic Filing Fee Paid

SUBTOTAL (3) ($) 500

SUBMITTED BY				Complete (*if applicable*)	
Name (Print/Type)	Christopher M. Brock	*Registration No. (Attorney/Agent)*	27313	*Telephone*	248-641-1600
Signature	Christopher M. Brock			*Date*	August 8, 2005

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

Application No.:	10/689,232
Filing Date:	October 20, 2003
Applicant:	Alan A. Gilmore
Group Art Unit:	2837
Examiner:	Rina I. Duda
Title:	Electrical Power Tool Having A Motor Control Circuit For Providing Control Over The Torque Output Of The Power Tool
Attorney Docket:	0275D-000113/COE

Mail Stop Appeal Brief - Patents
Director of the U.S. Patent and Trademark Office
P.O. Box 1450
Alexandria, VA 22313-1450

APPEAL BRIEF ON BEHALF OF APPELLANT

Dear Sir:

This is an appeal from the action of the Examiner dated May 5, 2005, finally rejecting claims 21-80. Copies of the appealed claims are attached as Appendix A.

I. Real Party In Interest

The real party in interest in the present application is Black & Decker Inc.

II. Related Appeals And Interferences

The grandparent of the present application, now U.S. Patent No. 6,424,799, was involved in an appeal before the U.S. Patent Office Board of Patent Appeals and Interferences. A copy of the Board's decision in that appeal is attached as Appendix B.

III. Status Of The Claims

Claims 21-80 are pending in the present application. All of the pending claims stand rejected and are appealed.

IV. Status Of Amendments

No amendments were filed by Appellant subsequent to the entry of the final rejection.

V. Summary Of Claimed Subject Matter

Applicant's invention relates to an electric motor-driven power tool, and in particular to a motor speed control circuit and method for controlling the operation of the motor to either automatically or selectively enable the user of the power tool to operate the tool in a pulsing mode.

Electrical power tools fall into two general categories: corded AC powered tools and cordless battery-operated, or DC powered tools. Corded AC power tools are designed to operate (in the United States) on standard 115-volt, 60 Hz AC house current. Speed control for corded AC power tools is typically implemented using a technique commonly known as "phase control". Because the universal motors used in power tools respond to RMS or average values of current and power, the speed of these motors can be varied by varying the RMS or average power applied to the motors. A phase control circuit accomplishes this by varying the conduction interval or "phase angle" of a solid-state switching device which controls the amount of power supplied to the motor during each full cycle of the AC waveform. Because the 115-volt

AC line signal has a smoothly varying waveform, changes in the conduction interval of the switching device result in gradual changes in the amount of power supplied to the motor, which in turn enables the motor to operate smoothly over its entire speed range.

Battery-operated DC power tools, of course, are not powered by a 60 Hz AC line signal and, therefore, the speed of a DC powered tool cannot practically be controlled using conventional phase control techniques. Instead, motor speed control of DC powered tools is typically implemented using a technique known as pulse width modulation ("PWM"). A PWM controller varies the RMS or average power supplied to a motor by varying the duty cycle of a relatively high frequency square-wave signal that controls the on/off state of a solid-state switching device connected between the DC power source and the motor. Thus, at low percentage duty cycle settings the speed of the motor is low, and at high percentage duty cycle settings the speed of the motor is high. To ensure smooth operation of the motor at all rotational speeds, despite the square-wave nature of the control signal, the frequency of the PWM control signal is typically set relatively high, such as 1 – 12 KHz. Consequently, even though the d.c. control signal, and hence the power supplied to the motor, is actually turning ON and OFF, the rate at which this is happening is so fast (e.g. 2,000 to 24,000 times per second) compared to the response time of the motor (due to the inductive characteristics of the motor), that the motor effectively "sees" an average power level signal that varies in direct proportion to the percentage duty cycle of the control signal. Hence, the output spindle of the motor rotates smoothly at all speed settings as the trigger switch of the power tool is retracted.

The present invention is directed to a new type of motor speed controller for powered tools. In particular, it has been determined that for certain power tool applications it is highly desirable to provide the operator with the ability to operate the tool in a "pulse mode" or "ratchet mode". As used herein, "pulse mode" or "ratchet mode" refers to the control of the motor of the power tool in such a way as to cause substantial discontinuous variation in the speed of rotation of the output spindle of the tool. For example, when setting a screw with a power screwdriver, it

is generally desirable to install the screw to a depth whereby the head of the screw is flush with or slightly below the surface of the workpiece. With conventional variable speed drills/screwdrivers this is difficult to accomplish consistently. However, by providing an operator with the ability to operate a power screwdriver in a pulse mode fashion, a screw can be slowly, incrementally rotated during final installation to facilitate accurate and repeatable setting of screw depth.

The present invention is directed to portable electric power tools and in particular to various alternative methods and apparatus for either automatically transitioning to, or selectively entering, a pulse mode of operation. In a first preferred embodiment, the control circuit is designed to monitor an operating parameter of the power tool and automatically transition to the pulse mode of operation in response to a predetermined change in the operating parameter.

In an alternative embodiment of the present invention, a switch is provided for enabling the operator to selectively switch between a "normal" mode of operation and a pulse mode of operation.

VI. GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

1. Claims 21, 30-40, 44-47, 50-56, and 60-80 stand rejected under 35 U.S.C. §102(b) as being anticipated by U.S. Patent No. 5,014,793 to Germanton et al. (hereinafter, the "'793" or "Germanton" patent).

2. Claims 22-29, 41-43, 48, 49 and 57-59 stand rejected under 35 U.S.C. §103(a) as being unpatentable over the same '793 Germanton patent.

VII. ARGUMENT

1. The Cited Germanton '793 Reference.

The Germanton reference is directed to a variable speed controller for a dc powered tool that includes what is known in the art as an "electronic clutch". In particular,

electric drills and power screw drivers typically include mechanical clutch assemblies that are connected between the gear train, which is driven by the output shaft of the motor, and the output spindle of the tool. These mechanical clutch assemblies are usually provided with an adjustment ring which the operator uses to select the desired maximum torque to be applied to the output spindle and hence to the fastener. When the selected torque level is attained, the mechanical clutch assembly uncouples the output spindle from the gear train to interrupt the application of torque to the output spindle. An example of a power tool with a mechanical clutch assembly of this type is shown, for example, in U.S. Patent No. 4,159,050.

As noted in the Background section of the Germanton reference, there are a number of disadvantages with mechanical clutch assemblies. Accordingly, it is the principal object of the Germanton patent to eliminate the mechanical clutch assembly and instead provide a variable speed DC controller that includes circuit means for "electronically clutching" the output spindle of the tool.

Toward this end, the Germanton power tool includes a torque control switch 13 for selectively setting the desired torque output of the tool (See col. 6, lines 3-7). The actual torque output of the tool is determined by monitoring the current through the motor which is proportional to the output torque of the tool (col. 7, lines 34-38). This is achieved through the use of a current sensing resistor (43 in Fig. 2 and 163 in Fig. 3) that is connected between the motor control FET (41 is Fig. 2 and 160 in Fig. 3) and ground. The desired torque signal (as determined by the setting of switch 13) is then compared to the actual torque output of the tool (as determined by the signal from current sense 43/163) by a comparator circuit (current overload torque reference 40 in Fig. 2; comparator 208 in Fig. 3). When the desired torque is exceeded by the actual torque, the comparator 208 provides an output signal that biases the motor control FET (41/160) OFF, thereby interrupting power to the motor. (See col. 11, lines 65-68). Thus, the torque control circuitry in the Germanton patent "electronically decouples" the motor from the output spindle of the tool when the desired or selected torque level is achieved.

The "second" switch 17 in the Germanton reference functions as a conventional variable speed trigger switch. The only difference is that the switch 17 in the Germanton patent is described as a "zero displacement" switch, rather than a traditional retractable trigger switch, and as such has no moving parts. Instead, the switch 17 has associated therewith a strain gage sensor array that senses the pressure applied to the switch by the user and varies accordingly the voltage of the output signal from the sensor array. (See col. 6, line 55-61).. This voltage signal is applied through a soft start circuit (34 in Fig. 2; components 70, 71 and 72 in Fig. 3), to a pulse width modulator circuit (36) which produces a PWM output signal whose duty cycle is proportional to the magnitude of the voltage signal from the pressure sensor array (col. 9, lines 6-13). Note that the frequency of operation of the PWM circuit is determined by the values of resistors 106, 107 and 110 and capacitor 111 (col. 8, line 68 to col. 9, line 3) which are <u>fixed</u>. Consequently, there is no way to vary the frequency of the PWM signal without physically changing the values of these components.

The PWM control signal is applied (via "logic circuit 39") to the gate of the FET (41/160) to control the speed of the motor. (Col. 11, lines 53-59). Note, that "logic circuit 39" is nothing more than the circuit node (unnumbered in Fig. 3) connecting the output from NAND gate 124 with the output from comparator 208, which is in turn connected to the gate of FET 160. Thus, when the output of the comparator 208 goes LO when the actual torque level exceeds the desired torque setting, the PWM control signal coming from NAND gate 124 is grounded and the FET 160 is turned OFF, thereby interrupting power to the motor.

2. <u>The Rejection Of Claims 21, 30-40, 44-47, 50-56 and 60-80 Under 35 U.S.C. §102(b).</u>

As is apparent from the above discussion in part 1., there is absolutely nothing in the Germanton reference to suggest that the variable speed control circuitry disclosed therein is anything more than a conventional PWM variable speed controller. In short, the Germanton reference does not teach or suggest a motor speed control circuit for an electric power tool that

is designed to purposefully "pulse" or "ratchet" the output spindle of the tool. Moreover, there is nothing in the Germanton reference that teaches or suggests that the controller is designed to change its operating mode, other than to simply interrupt power to the motor when the selected torque level is attained.

In the following discussion of the individual claims, the actual claim language is frequently paraphrased for convenience purposes only when addressing various points of distinction between the present invention and the cited Germanton reference. This is not to suggest or infer that any of the actual claim language is not important to the patentability of the claims with respect to any other prior art not expressly addressed herein.

(i) Claim 21. Claim 21 recites, inter alia, a portable power tool having a PWM controller that monitors an operating characteristic of the power tool and reduces the frequency of the PWM drive signal in response to a predetermined change in the operating characteristic "to thereby cause the power tool to enter a ratchet mode of operation." As noted above in part 1., the components of the PWM control circuit in the Germanton patent that determine the frequency of the PWM control signal are fixed value components. Consequently, there simply is no way that the Germanton reference can reduce "the frequency of said PWM drive signal...to thereby cause said power tool to enter a ratchet mode of operation" as recited in the claim. Therefore, claim 21 is clearly not anticipated by the '793 patent.

(ii) Claim 31. Claim 31 recites, inter alia, a controller for monitoring an operating characteristic of a power tool and adjusting the frequency of the drive signal in accordance with a predetermined change in the operating characteristic to cause the motor to enter a ratchet mode of operation. As noted above in part 1., the components of the PWM control circuit in the Germanton patent that determine the frequency of the PWM control signal are fixed value components.

Consequently, there simply is no way that the Germanton reference can adjust "the frequency of the drive signal...to cause the motor to enter a ratchet mode of operation" as recited in the claim. Therefore, claim 31 is clearly not anticipated by the '793 patent.

(iii) Claim 35. Dependent claim 35 recites that the predetermined change corresponds to a rate of increase in motor current above a predetermined threshold. The Germanton patent only monitors the present value of motor current, not a rate of change, and interrupts power to the motor when the current value exceeds a selected threshold. Therefore, claim 35 is not anticipated by the '793 patent for this additional reason as well.

(iv) Claims 36 and 37. Dependent claim 36 recites that the monitored operating characteristic is the speed of the motor. Claim 37 further recites that the predetermined change is a decrease in the speed of the motor below a predetermined threshold. The Germanton reference only monitors motor current. Therefore, claims 36 and 37 are not anticipated by the '793 patent for these additional reasons as well.

(v) Claim 38. Dependent claim 38 further recites that the predetermined change corresponds to a deceleration rate in motor speed below a predetermined threshold. The Germanton patent only monitors the present value of motor current, not a rate of change. Therefore, claim 38 is not anticipated by the '793 patent for this additional reason as well.

(vi) Claim 44. Claim 44 recites, inter alia, a power tool having an electric motor, a "first operator actuable device" (e.g. a trigger switch) and a control circuit for controlling the amount of power applied to the motor, and "a second operator actuable device for selectively causing said control circuit to operate the motor in a pulse mode that produces substantial cyclical variations in the torque applied to

said output spindle." The Germanton patent has a PWM control circuit and the equivalent of a trigger switch for controlling the amount of power applied to the motor. The other "operator actuable device" in the Germanton patent is the torque control switch 13 which sets the desired maximum torque output of the tool. When this torque level is attained, the control circuit in the Germanton patent does not "operate the motor in a pulse mode that produces substantial cyclical variations in the torque applied to [the] output spindle". Rather, the control circuit in the Germanton patent simply completely interrupts power to the motor. Therefore, claim 44 is not anticipated by the '793 patent.

(vii) Claim 46. Dependent claim 46 further recites that the second operator actuable device comprises a switch for selectively switching the control circuit between two operating modes: a "normal" mode and a "pulse" mode. Moreover, the pulse mode is expressly defined as requiring the power supply to the motor to be interrupted "by OFF periods of sufficient duration to cause discontinuous incremental rotation of the output spindle." This defined mode of operation is not taught by the Germanton patent. Therefore, claim 46 is not anticipated by the '793 patent for this additional reason as well.

(viii) Claim 50. Claim 50 recites, inter alia, a power tool having an electric motor for driving an output spindle, a control circuit, and first and second operator actuable devices, wherein the second operator actuable device selectively causes the control circuit to operate the motor in a pulse mode "by cycling the power supplied to the motor ON and OFF with the intervening OFF periods being of sufficient duration to cause discontinuous incremental rotation of said output spindle". As noted previously, the control circuit in the Germanton patent is not designed to operate in this defined manner. Nor is the torque control switch in the Germanton patent used to selectively operate the control circuit in two

different operating modes. (Note, simply interrupting power to the motor is not an "operating" mode.) Therefore, claim 50 is not anticipated by the '793 patent.

(ix) Claims 54 and 56. Dependent claims 54 and 56 further recite that each increment of rotation of the output spindle in the pulse mode of operation is less than a full revolution of said output spindle. This concept is not disclosed anywhere in the Germanton patent. Accordingly, claims 54 and 56 are not anticipated for this additional reason as well.

(x) Claim 60. Claim 60 defines, inter alia, a power tool having an electric motor for driving an output spindle and a control circuit for controlling the power supplied to the motor, wherein the control circuit operates in two modes: a first operating mode wherein the motor provides a substantially smooth application of torque to an output spindle, and a second operating mode wherein the motor provides "bursts of torque to said output spindle that produce substantial variation in the speed of rotation of said output spindle between successive bursts of torque". The control circuit in the Germanton patent does not have two operating modes; (OFF is not by definition an operating mode). Moreover, the PWM control circuit in the Germanton patent only operates in the above-defined first or "smooth" mode. As with any conventional PWM motor control circuit, the Germanton patent does produce a drive signal that comprises a series of pulses. However, the frequency of the drive signal is so high (i.e. the number of pulses produced each second is so great), the motor does NOT pulse as a result. Rather, due to the inherent inductive characteristics of the motor, and hence the response time of the motor, the motor operates as if it were being driven by a pure analog signal whose magnitude changes as the percentage duty cycle of the PWM drive signal changes. There is nothing in the disclosure of the Germanton patent that teaches the concept of controlling the motor so as to provide bursts of torque to

the output spindle that produce substantial variation in the speed of rotation of the output spindle between successive bursts of torque. The controller in the Germanton patent either drives the output spindle smoothly or interrupts power to the motor completely. Therefore, claim 60 is not anticipated by the '793 patent.

(xi) Claims 62 and 63. Dependent claims 62 and 63 add the further limitations that the output spindle comes substantially to a stop under load between successive bursts of torque, and further that the duration of each of the successive bursts of torque is sufficiently brief to produce less than a full revolution of the output spindle. The Germanton patent is completely devoid of any teaching of an operating mode of the control circuit whereby the motor drives the output spindle in this defined manner. Therefore, for these additional reasons, claims 62 and 63 are also not anticipated by the '793 patent.

(xii) Claim 64. For purposes of the present discussion and the fundamental distinctions between the present invention and the teachings of the cited Germanton reference, method claim 64 corresponds in substantial part to apparatus claim 60. Accordingly, claim 64 is also not anticipated by the '793 patent for the reasons set forth in subpart (x) above.

(xiii) Claims 65 and 66. For purposes of the present discussion and the fundamental distinctions between the present invention and the teachings of the cited Germanton reference, dependent method claims 65 and 66 correspond in substantial part to apparatus claims 62 and 63. Accordingly, for the reasons discussed in subpart (xi), claims 65 and 66 are also not anticipated by the '793 patent.

(xiv) Claim 67. Claim 67 recites inter alia, a method of selectively operating a power tool having an electric motor for driving an output spindle in either a first mode wherein the motor imparts a continuous application of torque to the output

spindle, or in a second mode wherein the motor imparts "a non-uniform application of torque to said output spindle of sufficient variation to cause said output spindle to rotate in a series of discrete increments." The Germanton patent discloses a PWM control circuit that only functions in the first mode of operation defined by claim 67. In other words, the "pulse control signal" referred to in the Germanton patent is merely a conventional PWM control signal that is cycled on and off at a very high frequency so that the output spindle of the tool is driven smoothly. The second mode of operation defined in claim 67 is completely absent from the teachings of the Germanton patent. Accordingly, claim 67 is clearly not anticipated by the '793 patent.

(xv) Claim 69. Dependent claim 69 adds the further limitation that each discontinuous increment of rotation is less than a full revolution of the output spindle. As noted above, this control concept is totally absent from the Germanton patent. Accordingly, for this additional reason, claim 69 is also not anticipated by the '793 patent.

(xvi) Claim 70. Claim 70 recites a method of controlling a power tool having an electric motor for driving an output spindle, "by pulsing the motor so that a series of discontinuous torque bursts are imparted to the output spindle of the tool, said torque bursts causing said output spindle to rotate in a corresponding series of discontinuous increments each of which is less than a full revolution of said output spindle." As with any conventional PWM motor control circuit, the Germanton patent does produce a drive signal that comprises a series of pulses. However, the frequency of the drive signal is so high (i.e. the number of pulses produced each second is so great), the motor does NOT pulse as a result. Rather, due to the inherent inductive characteristics of the motor, and hence the response time of the motor, the motor operates as if it were being driven by a

pure analog signal whose magnitude changes as the percentage duty cycle of the PWM drive signal changes. Thus, the Germanton patent does not pulse the motor so that a series of discontinuous torque bursts are imparted to the output spindle. As long as power is being supplied to the motor by the controller in the Germanton patent, the motor runs smoothly. In addition, claim 70 further recites that the discontinuous torque bursts from the motor cause the output spindle of the tool "to rotate in a corresponding series of discontinuous increments each of which is less than a full revolution of said output spindle." There is absolutely nothing in the Germanton patent that teaches or suggests this mode of operation. Accordingly, claim 70 is clearly not anticipated by the '793 patent.

(xvii) Claim 72. For purposes of distinguishing over the cited Germanton reference, claim 72 is similar to claim 67 in that claim 72 recites two modes of operation: a first "normal" mode (which corresponds to the method of operation disclosed in the Germanton patent), or "a second mode wherein power is supplied to the motor in a manner that imparts bursts of torque to said output spindle that produce substantial variations in the speed of rotation of said output spindle between successive bursts of torque." Further, as discussed above in subpart (x), there is nothing in the Germanton patent that teaches the concept of controlling the motor so as to impart bursts of torque to the output spindle that produce substantial variation in the speed of rotation of the output spindle between successive bursts of torque. The Germanton patent teaches only to control the motor so that it rotates smoothly. Therefore, claim 72 is not anticipated by the '793 patent.

(xviii) Claims 73 and 74. Dependent claims 73 and 74 add the further recitations that the duration of each successive burst of torque is sufficiently brief to produce incremental rotation of the output spindle less than a full rotation, and preferably

less than or equal to one-half turn of the output spindle. As noted above, this control concept is totally absent from the Germanton patent. Accordingly, for these additional reasons, claims 73 and 74 are also not anticipated by the '793 patent.

(xix) Claim 76. Claim 76 recites, inter alia, a portable power tool having an electric motor for driving an output spindle and a control circuit for producing a drive signal that is supplied to a power switching device "so that the motor drives the output spindle in a pulse mode that causes substantial cyclical variation in the rotational speed of the output spindle." Note, claim 76 expressly recites that the output spindle is driven in a pulse mode. Moreover, the "pulse mode" causes "substantial cyclical variation" in the rotational speed of the output spindle. There is nothing in the Germanton reference that teaches or suggests this control technique. As discussed in subpart (x) above, the controller in the Germanton patent may be supplying a PWM control signal to the motor, but there is nothing in the Germanton reference to suggest that the motor is in turn driving the output spindle in a pulse mode that causes substantial cyclical variation in its rotational speed. Therefore, claim 76 is not anticipated by the '793 patent.

(xx) Claim 77. Dependent claim 77 further recites that the drive signal causes the motor to produce a series of torque bursts that drive the output spindle in a corresponding series of discontinuous rotational increments. This operational control technique is not taught by the Germanton patent. There is nothing in the Germanton patent to suggest that the output spindle is ever driven in other than a continuous manner. Accordingly, for this additional reason, claim 77 is also not anticipated by the '793 patent.

(xxi) Claim 78. Dependent claim 78 further recites that teach of said rotational increments is less than a full revolution of the output spindle. As noted above,

this concept is also totally absent from the Germanton patent. Accordingly, for this additional reason, claim 78 is not anticipated by the '793 patent.

(xxii) Claim 78. Dependent claim 78 further recites that each of said rotational increments is less than a full revolution of the output spindle. As noted above, this concept is also totally absent from the Germanton patent. Accordingly, for this additional reason, claim 78 is not anticipated by the '793 patent.

(xxiii) Claim 80. Dependent claim 80 further recites an operator actuable switch for selectively switching the control circuit between the pulse mode and the continuous rotational mode of operation. As noted above, the torque control switch 13 in the Germanton patent is provided to selectively set the desired final torque output of the tool which, when attained, interrupts power to the motor. Thus, the switch 13 in the Germanton patent does not serve the same function as the switch recited in the claim. Accordingly, for this additional reason, dependent claim 80 is also not anticipated by the '793 patent.

3. The Rejection of Claims 22-29, 41-43, 48, 49 and 57-59 Under 35 U.S.C. §103(a).

(i). Claim 22. Claim 22 depends from claim 21 (see part 2(i) above) and further recites that the frequency of the PWM drive signal is reduced to a frequency of less than 50 Hz. The Examiner has in effect conceded that the Germanton patent does not disclose this concept, asserting rather that the frequency of the PWM drive signal is a matter of obvious design choice by one of ordinary skill in the art. Applicant has challenged this assertion pointing out the fact that the recited frequency range is several orders of magnitude below the normal frequency range employed in typical PWM controllers, and consequently results in a dramatically different operating condition than is customarily provided. Despite Appellant's express challenge of this assertion, the Examiner has maintained the rejection without the citation of any supporting art. On this basis alone the rejection is clearly improper and should be reversed. It is a longstanding

and fundamental precept of patent law that whenever an applicant challenges an unsupported assertion of obviousness as a "matter of choice", it is incumbent upon the Examiner to cite art in support of the assertion. Ex parte Cady, 148 USPQ 162 (Bd. of App. 1965). The Examiner has failed to do.

Moreover, as pointed out in Appellant's response to the initial Office Action in this case, the recited frequency range of "less than 50 Hz" has nothing to do with the selection of "an optimum value" of a variable. Conventional variable speed PWM control circuits are designed to provide smooth motor operation throughout the speed range of the motor. Thus, if Appellant were claiming a particular high frequency value which achieved "optimum" smooth performance for a particular motor design, the Examiner's statement would have merit. In the present case, however, the claimed frequency range causes dramatically different operational results which are completely contrary to the design intent of known PWM controllers. Accordingly, the claimed frequency range is anything but obvious from the cited art, and has nothing to do with any intent to "optimize" the normal operation of a conventional variable speed controller. Moreover, there is nothing in the Germanton patent to suggest that a pulse or ratchet mode of operation as defined in the present application is intended or even desired. Therefore, one of ordinary skill in the art, from the teachings of the Germanton patent, would never consider selecting such an extremely low frequency for the PWM control signal. Accordingly, it is respectfully submitted that claim 22 is not obvious in view of the '793 patent.

(ii). Claim 25. Dependent claim 25 further recites that the predetermined change in the operating characteristic of the tool "corresponds to a rate of increase in motor current above a predetermined threshold. For the additional reasons discussed in subpart 2.(iii) above, claim 25 is also not obvious in view of '793 patent for this additional reason as well.

(iii). Claims 26 and 27. For present purposes, these dependent claims recite the same additional subject matter as dependent claims 36 and 37. Therefore, for the reasons discussed

in subpart 2.(iv) above, claims 26 and 27 are also not obvious in view of the '793 patent for these additional reasons as well.

(iv). Claim 28. For present purposes, dependent claim 28 recites the same additional subject matter as dependent claim 38. Therefore, for the reasons discussed in subpart 2.(v) above, claim 28 is also not obvious in view of the '793 patent for this additional reason as well.

(v). Claim 41. For present purposes, dependent claim 41 recites in substantial part the same additional subject matter as dependent claim 22. Therefore, for the reasons discussed in subpart 3.(i) above, claim 41 is also not obvious in view of the '793 patent for these additional reasons as well.

(vi). Claim 48. Dependent claim 48 expressly recites that the "control circuit cycles the power to the motor in said second pulse mode of operation at a frequency of less than 50 Hz". In the Germanton patent, the power to the motor is controlled by a PWM control circuit having a power FET (41 in Fig. 2 and 160 in Fig. 3) that is rapidly switched ON and OFF at a very high frequency during normal operation, and biased completely OFF to interrupt power to the motor when the selected torque level is achieved. There is no separate control circuit in the Germanton patent that turns the PWM control circuit ON and OFF at a frequency less than 50 Hz., nor is the frequency of the PWM drive signal itself less than 50 Hz. Accordingly, for the additional reasons discussed in subpart 3.(i) above, claim 48 is also not obvious in view of the '793 patent for these additional reasons as well.

(vii) Claim 49. Dependent claim 49 adds the recitation wherein the switch used to select between the first and second operating modes "selectively sets the frequency of said PWM control signal to a relatively high frequency in said first mode of operation and to a relatively low frequency less than 50 Hz in said second pulse mode of operation." As noted previously, the frequency of operation of the PWM control circuit in the Germanton reference is determined by the values of resistors 106, 107 and 110 and capacitor 111 (See col. 8, line 68 to col. 9, line 3) which are fixed. Consequently, there is no way in the Germanton patent to change the

frequency of the PWM control signal. In addition, as also previously noted, the torque control switch 13 in the Germanton patent controls the setting of the desired torque level (See col. 6, lines 3-7), not the frequency of the PWM control signal. Accordingly, claim 49 is additionally not obvious in view of the '793 patent for these additional reasons as well.

(viii). Claim 57. Claim 57 recites, inter alia, a power tool having a motor for driving an output spindle and a control circuit for controlling the power supplied to the motor, wherein the control circuit controls the power to the motor by "cyclically turning the power ON and OFF at a frequency of less than 50 Hz." As noted above, in the Germanton patent the power to the motor is controlled by a PWM control circuit having a power FET (41 in Fig. 2 and 160 in Fig. 3) that is rapidly switched ON and OFF at a very high frequency during normal operation, and biased completely OFF to interrupt power to the motor when the selected torque level is achieved. There is no separate control circuit in the Germanton patent that turns the PWM control circuit ON and OFF at a frequency less than 50 Hz., nor is the frequency of the PWM control signal itself less than 50 Hz. Accordingly, there is nothing in the Germanton patent that teaches or suggests the claimed control technique. Moreover, for the reasons discussed in subpart 3.(i) above, the recitation of "a frequency of less than 50 Hz." is not a matter of design choice that would be obvious to one of ordinary skill in the art. Therefore, claim 57 is not obvious in view of the teachings of the '793 patent.

(ix). Claim 59. Dependent claim 59 adds the further recitation that each increment of rotation of the output spindle is less than a full revolution of the output spindle. For the additional reasons discussed in subpart 2.(ix) above, claim 59 is not obvious in view of the '793 patent.

4. Conclusion.

For the reasons discussed above, claims 21-80 are neither anticipated by nor rendered obvious in view of the Germanton '793 patent. Therefore, the final rejection of the Examiner dated May 5, 2004 should be reversed and the present application passed on to allowance.

Respectfully submitted,

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CMB/jb
August 8, 2005
Attachments

APPENDIX A

CLAIMS ON APPEAL

21. A portable power tool having an output spindle, an electric motor for driving the output spindle and a control system for controlling the operation of the motor including a power source and a power switching device interconnecting the power source to the motor for applying a constant frequency PWM drive signal from the power source to the motor, and a controller for controlling the power switching device and monitoring at least one operating characteristic of the power tool and reducing the frequency of said PWM drive signal in response to a predetermined change in said operating characteristic to thereby cause said power tool to enter a ratchet mode of operation.

22. The power tool of claim 21 wherein said frequency of said PWM drive signal is reduced to a frequency less than 50 Hz.

23. The power tool of claim 22 wherein said operating characteristic is motor current.

24. The power tool of claim 23 wherein said predetermined change is an increase in motor current above a predetermined threshold.

25. The power tool of claim 23 wherein said predetermined change corresponds to a rate of increase in motor current above a predetermined threshold.

26. The power tool of claim 22 wherein said operating characteristic is the speed of the motor.

27. The power tool of claim 26 wherein said predetermined change is a decrease in the speed of the motor below a predetermined threshold.

28. The power tool of claim 26 wherein said predetermined change corresponds to a deceleration rate in the speed of the motor below a predetermined threshold.

29. The power tool of claim 22 further including an operator actuable trigger switch and wherein said controller further controls the amount of power supplied to the motor by varying the duty cycle of the PWM drive signal in accordance with the actuated position of said trigger switch.

30. The power tool of claim 21 wherein said power source is a battery.

31. A control system for a portable power tool having an output spindle driven by an electric motor of the type that is responsive to the total power supplied to the motor via a drive signal for controlling the speed of the motor, said drive signal having associated therewith a frequency, the control system comprising:

a power switching device interconnecting the motor to a power source for applying said drive signal to said motor; and

a controller for monitoring an operating characteristic of the power tool and adjusting the frequency of the drive signal in accordance with a predetermined change in said operating characteristic to cause the motor to enter a ratchet mode of operation.

32. The control system of claim 31 wherein said power source is a battery directly coupled to the power tool.

33. The control system of claim 31 wherein said operating characteristic is motor current.

34. The control system of claim 33 wherein said predetermined change is an increase in motor current above a predetermined threshold.

35. The control system of claim 33 wherein said predetermined change corresponds to a rate of increase in motor current above a predetermined threshold.

36. The control system of claim 31 wherein said operating characteristic is the speed of the motor.

37. The control system of claim 36 wherein said predetermined change is a decrease in the speed of the motor below a predetermined threshold.

38. The control system of claim 36 wherein said predetermined change corresponds to a deceleration rate in the speed of the motor below a predetermined threshold.

39. The control system of claim 31 further including an operator actuable trigger switch and wherein said controller further controls the amount of power supplied to the motor by controlling a characteristic of said drive signal in accordance with the actuated position of said trigger switch.

40. The control system of claim 39 wherein said drive signal is a PWM signal and said characteristic of said drive signal is the duty cycle of the PWM signal.

41. The control system of claim 40 wherein said controller reduces the frequency of said PWM drive signal from a relatively high value to a low value less than 50 Hz in response to a predetermined change in said operating characteristic.

42. The control system of claim 41 wherein the frequency of said drive signal is sufficiently low to cause said power tool to enter into a ratchet mode of operation.

43. The control system of claim 42 wherein said power source is a battery directly coupled to the power tool and said PWM drive signal is a d.c. signal.

44. A power tool having an electric motor for driving an output spindle, a first operator actuable device for controlling the amount of power applied to the motor, and a control circuit for modulating the power supplied to the motor in accordance with the actuation of said first operator actuable device; the improvement comprising a second operator actuable device for selectively causing said control circuit to operate the motor in a pulse mode that produces substantial cyclical variations in the torque applied to said output spindle.

45. The power tool of claim 44 wherein said first operator actuable device is a retractable trigger and the control circuit modulates the power supplied to the motor in accordance with the position of the trigger.

46. The power tool of claim 45 wherein said second operator actuable device comprises a switch for selectively switching said control circuit between a first operating mode wherein the modulated power supplied to the motor results in the smooth application of torque to the output spindle and a second pulse mode of operation wherein the power supplied to the

motor is interrupted by OFF periods of sufficient duration to cause discontinuous incremental rotation of the output spindle.

47. The power tool of claim 46 wherein said control circuit produces a PWM control signal that is supplied to the motor and further wherein the duty cycle of the PWM control cycle is varied in accordance with the position of the trigger.

48. The power tool of claim 47 wherein said control circuit cycles the power to the motor in said second pulse mode of operation at a frequency of less than 50 Hz.

49. The power tool of claim 47 wherein said switch selectively sets the frequency of said PWM control signal to a relatively high frequency in said first mode of operation and to a relatively low frequency less than 50 Hz in said second pulse mode of operation.

50. A power tool having an electric motor for driving an output spindle, a first operator actuable device having a plurality of settings, and a control circuit connected to said first operator actuable device and to said electric motor, said control circuit controlling the amount of electrical power supplied to the motor by modulating an electrical signal in accordance with the setting of said first operator actuable device; the improvement comprising a second operator actuable device connected to said control circuit for selectively causing said control circuit to operate said motor in a pulse mode by cycling the power supplied to the motor ON and OFF with the intervening OFF periods being of sufficient duration to cause discontinuous incremental rotation of said output spindle.

51. The power tool of claim 50 wherein said first operator actuable device is a retractable trigger and the control circuit modulates the power supplied to the motor in accordance with the position of the trigger.

52. The power tool of claim 51 wherein said second operator actuable device comprises a switch for selectively switching said control circuit between a first operating mode wherein the modulated power supplied to the motor results in the smooth application of torque to the output spindle and a second operating mode corresponding to said pulse mode.

53. The power tool of claim 52 wherein said OFF periods are of sufficient duration to cause the output spindle under operative load conditions to come to a complete stop between each incremental rotation of the output spindle.

54. The power tool of claim 53 wherein each increment of rotation of said output spindle is less than a full revolution of said output spindle.

55. The power tool of claim 46 wherein said OFF periods are of sufficient duration to cause the output spindle under operative load conditions to come to a complete stop between each incremental rotation of the output spindle.

56. The power tool of claim 55 wherein each increment of rotation of said output spindle is less than a full revolution of said output spindle.

57. A power tool having an electric motor for driving an output spindle having a tool holder operatively coupled thereto, an operator actuable switch for controlling the amount of power applied to the motor, and a control circuit for modulating the power supplied to the motor

in accordance with the position of said switch by varying the duty cycle of a constant frequency, pulse width modulated (PWM) direct current (d.c.) control signal generated by the control circuit to thereby control the speed of the motor; the improvement wherein said control circuit further controls the power to the motor, with said switch in a substantially fixed position, by cyclically turning the power ON and OFF at a frequency of less than 50 Hz.

58. The power tool of claim 57 wherein said OFF periods are of sufficient duration to cause the output spindle under operative load conditions to come to a complete stop between each incremental rotation of the output spindle.

59. The power tool of claim 58 wherein each increment of rotation of said output spindle is less than a full revolution of said output spindle.

60. A power tool having an electric motor for driving an output spindle having a tool holder operatively coupled thereto, an operator actuable switch for controlling the amount of power applied to the motor, and a control circuit for modulating the power supplied to the motor in accordance with the position of said switch by varying the duty cycle of a constant frequency, pulse width modulated (PWM) direct current (d.c.) control signal generated by the control circuit to thereby control the speed of the motor; the improvement wherein said control circuit in a first operating mode generates said PWM d.c. control signal to cause said motor to provide a substantially smooth application of torque to said output spindle over substantially the entire duty cycle range of said control signal, and in a second operating mode generates said PWM d.c. control signal to cause said motor to provide bursts of torque to said output spindle that produce substantial variation in the speed of rotation of said output spindle between successive bursts of torque.

61. The power tool of claim 60 further including a second operator actuable device for selectively switching said control circuit between said first and second operating modes.

62. The method of claim 61 wherein the output spindle of the tool intermittently comes substantially to a stop under an operative load condition between successive bursts of torque.

63. The method of claim 62 wherein the duration of each of said successive bursts of torque is sufficiently brief in time to produce less than a full revolution of said output spindle.

64. A method of controlling a power tool having an electric motor for driving an output spindle having a tool holder operatively coupled thereto and a control circuit that is responsive to a first operator actuable device for controlling the amount of power applied to the motor, the method comprising the steps of:

modulating the power to the motor in accordance with the position of said first operator actuable device by varying the duty cycle of a constant frequency, pulse width modulated (PWM) direct current (d.c.) control signal generated by the control circuit to thereby control the speed of the motor; and

cyclically turning said PWM d.c. control signal ON and OFF at a sufficiently low frequency to cause the motor to provide bursts of torque to said output spindle that produce substantial variation in the speed of rotation of said output spindle between successive bursts of torque.

65. The method of claim 64 wherein the output spindle of the tool intermittently comes substantially to a stop under an operative load condition between successive bursts of torque.

66. The method of claim 65 wherein the duration of each of said successive bursts of torque is sufficiently brief in time to produce less than a full revolution of said output spindle.

67. In a power tool having an electric motor for driving an output spindle, the method of selectively operating the power tool in either a first mode wherein power is supplied to the motor in a manner that imparts a continuous application of torque to said output spindle, or in a second mode wherein power is supplied to the motor in a manner that imparts a non-uniform application of torque to said output spindle of sufficient variation to cause said output spindle to rotate in a series of discontinuous increments.

68. The method of claim 67 wherein power to the motor in said second mode is applied during a succession of brief periods sufficiently spaced apart in time to enable said output spindle under operative load conditions to come to a substantial stop between successive brief periods.

69. The method of claim 67 wherein each discontinuous increment of rotation is less than a full revolution of said output spindle.

70. In a power tool having an electric motor for driving an output spindle, the method of controlling the electric motor by pulsing the motor so that a series of discontinuous torque bursts are imparted to the output spindle of the tool, said torque bursts causing said output spindle to rotate in a corresponding series of discontinuous increments each of which is less than a full revolution of said output spindle.

71. The method of claim 70 wherein said torque bursts are sufficiently spaced apart in time to enable said output spindle under operative load conditions to come to a substantial stop between successive torque bursts.

72. In a power tool having an electric motor for driving an output spindle, the method of selectively operating the power tool in either a first mode wherein power is supplied to the motor in a manner that imparts a continuous application of torque to said output spindle, or in a second mode wherein power is supplied to the motor in a manner that imparts bursts of torque to said output spindle that produce substantial variation in the speed of rotation of said output spindle between successive bursts of torque.

73. The method of claim 72 wherein the duration of each of said successive bursts of torque is sufficiently brief in time to produce incremental rotation less than a full revolution of said output spindle.

74. The method of claim 73 wherein each increment of rotation is less than or equal to one-half turn of said output spindle.

75. The method of claim 72 wherein the output spindle of the tool intermittently comes substantially to a stop under an operative load condition between successive bursts of torque.

76. A portable power tool having an output spindle, an electric motor for driving the output spindle, and a control circuit for controlling the operation of the motor including a power switching device interconnecting a power source to the motor for controlling the application of power to the motor, said control circuit producing a drive signal that is supplied to said power

switching device to control the operation of said power switching device so that the motor drives the output spindle in a pulse mode that causes substantial cyclical variation in the rotational speed of the output spindle.

77. The power tool of claim 76 wherein said drive signal causes the motor to produce a series of torque bursts that drive the output spindle in a corresponding series of discontinuous rotational increments.

78. The power tool of claim 77 wherein each of said rotational increments is less than a full revolution of the output spindle.

79. The power tool of claim 76 wherein said control circuit is further adapted to produce a drive signal that causes the motor to drive the output spindle in a continuous rotational mode wherein the rotational speed of the motor is varied in accordance with an operating characteristic of the drive signal.

80. The power tool of claim 79 further including an operator actuable switch for selectively switching the control circuit between said pulse mode and said continuous rotational mode.

APPENDIX B

The opinion in support of the decision being entered today was not written for publication and is not binding precedent of the Board.

Paper No. 35

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

MAILED

FEB 2 0 2002

PAT. & T.M. OFFICE
BOARD OF PATENT APPEALS
AND INTERFERENCES

Ex parte ALAN A. GILMORE

Appeal No. 1999-2638
Application No. 08/834,774

HEARD: January 8, 2002

Before LALL, LEVY, and BLANKENSHIP, Administrative Patent Judges.

BLANKENSHIP, Administrative Patent Judge.

DECISION ON APPEAL

This is a decision on appeal under 35 U.S.C. § 134 from the examiner's final rejection of claims 1-8, 11, 12, and 21-30.

We reverse.

BACKGROUND

The invention is directed to a method and apparatus for controlling the effective torque output of a power tool. Claim 1 is reproduced below.

> 1. A power tool having an electric motor for driving an output spindle having a tool holder operatively coupled thereto, an operator actuable switch for controlling the amount of power applied to the motor, and a control circuit for modulating the power supplied to the motor in accordance with the position of said switch by varying the duty cycle of a constant frequency, pulse width modulated (PWM) direct current (d.c.) control signal generated by the control circuit to thereby control the speed of the motor; the improvement wherein the frequency of the PWM d.c. control signal generated by said control circuit is less than 50 Hz.

The examiner relies on the following reference:

Saar et al. (Saar)	4,447,786	May 8, 1984

Claims 1-8, 11, 12, and 21-30 stand rejected under 35 U.S.C. § 103 as being unpatentable over Saar.

Claims 19 and 20 have been allowed. Although the Examiner's Answer, at page 4, includes claims 19 and 20 as standing rejected, page 5 of the Answer unequivocally indicates that the examiner considers the claims to be allowable.

Claims 9, 10, and 13-18 have been canceled.

We refer to the Final Rejection (mailed March 30, 1998) and the Examiner's Answer (mailed Dec. 18, 1998) for a statement of the examiner's position and to the Brief (filed Oct. 1, 1998) and the Reply Brief (filed Feb. 22, 1999) for appellant's position with respect to the claims which stand rejected.

OPINION

At the outset, we note that the instant file wrapper contains a paper filed pursuant to 37 CFR § 1.181, with a filing date the same as that of the Reply Brief (Feb. 22, 1999), requesting reconsideration of the examiner's deemed grouping of the claims. There is no indication in the record, however, that the petition was ever considered; no paper has been filed by the Office in response. To avoid remand of the instant application for due consideration of the paper, with the concomitant delay in disposition of the instant appeal, at the oral hearing appellant's representative agreed to withdraw the request for reconsideration.[1]

We turn to consider the claims at issue. We observe that three of the independent claims before us -- 1, 3, and 7 -- are drafted in the well-known Jepson format. We interpret each as setting forth elements which are conventional or known in the portion preceding "the improvement comprising," with the conventional or known elements forming part of the combination. See, e.g., Rowe v. Dror, 112 F.3d 473, 478, 42 USPQ2d 1550, 1553 (Fed. Cir. 1997).

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[1] Moreover, under current rules, the Board ultimately determines the effective grouping of the claims, based on the arguments presented by the appellant. See 37 CFR § 1.192(c)(7) ("For each ground of rejection which appellant contests and which applies to a group of two or more claims, the Board shall select a single claim from the group and shall decide the appeal as to the ground of rejection on the basis of that claim alone unless a statement is included that the claims of the group do not stand or fall together and, in the argument under paragraph (c)(8) of this section, appellant explains why the claims of the group are believed to be separately patentable.").

Appellant's main contention, in view of the arguments presented in the briefs, is that the section 103 rejection over Saar is erroneous because, contrary to the examiner's findings, the reference does not disclose the pulse width modulated (PWM) signal to be of "constant frequency." The feature is a requirement of, for example, instant (Jepson format) claim 1.

We find Saar to be directed to a waveform synthesizer suitable for driving AC motors in hand-held power tools having a DC power source (e.g., col. 1, ll. 12-48). In particular, Saar is directed to the problem of "selectively switch[ing] power pulses of selected pulse width, spacing, and repetition rate from an oppositely poled direct current power source to the power receiving device to synthesize a current waveform of selected wave shape and frequency." Col. 2, ll. 14-19.

As shown in Figure 1, and as described at column 3, line 16 through column 4, line 60, switching device 12 receives input power from positive and negative buses 14 and 16 of the DC power supply. Since switching device 12 is switching DC voltage (Fig. 2A) into load 18, it is desirable that the load have some inductive reactance to develop the desired wave shape (Fig. 2). Figure 2A shows the pulse width switch-modulated output of switching device 12. The amplitude of the pulses is controlled by the supplied DC voltage, and the duration of each pulse and the inter-pulse spacing are independently controlled by the switching information provided from the memory 20. For synthesizing the sine wave shown in Figure 2, the switched voltage output of

device 12 has a comparatively narrow pulse duration with the next successive pulses having progressively greater pulse durations. The center pulse has the greatest duration, with the succeeding pulses having progressively diminishing durations. By controlling the number, spacing, and width of the output pulses, a waveform of desired shape can be obtained. Different wave shapes are stored within memory 20, and may be selected by microprocessor 24 addressing a different page within the memory. Frequency of the synthesized output waveform can be changed by changing the programmable frequency divider 32. The reference discloses a "practical embodiment" (Fig. 3) of the inventive waveform synthesizer, described at column 5, line 7 et seq.

Appellant contends that the pulses shown in Figure 2A of the reference are not of "constant frequency" (e.g., Brief at 8-9; Reply Brief at 2-5). The examiner states the view: "Saar et al.'s figure 2A is produced for every cycle. Thus if the frequency is 48 Hz the PWM is at 48 Hz. Clearly, in column 9 lines 30-36 teach [sic] that the lower the constant frequency i.e. 6 Hz the slower the speed." (Final Rejection at 3.)

Figure 2A of Saar, presumably, shows half a wavelength of a periodic signal, which corresponds to the half-wavelength sine wave shown in Figure 2. Further, presumably, the second half of the wavelength of Figure 2A, corresponding to the second (negative) half of the sine waveform (not shown), would appear as a folded mirror image of the signal shown -- that is, with pulses equal in width and magnitude to those shown, but of opposite polarity. The entire pulsed signal is produced from the

DC source at buses 14 and 16 (Fig. 1). The periodic waveform shown in Saar's Figure 2A, producing and corresponding to the periodic, constant frequency sine wave shown in Figure 2, might thus be considered a "constant frequency, pulse width modulated (PWM) direct current (d.c.) control signal generated by the control circuit," as set forth in instant claim 1.

Claim 1, however, further requires that the control circuit modulates "the power supplied to the motor <u>in accordance with the position of said</u> [operator actuable] <u>switch by varying the duty cycle</u> of ... [the constant frequency signal] to thereby control the speed of the motor" (emphasis added). A definition for "duty cycle," pertinent to the electronic arts, is "the ratio of the 'on' period of a pulse to the total pulse period." <u>Academic Press Dictionary of Science and Technology</u>, Harcourt, <u>available at</u> http://www.harcourt.com/dictionary/def/3/2/9/8/3298000.html (Jan. 17, 2002). Saar discloses controlling the number, spacing, and width of the pulses output from switching device 12 in order to synthesize different waveforms. It is far from clear, on this record, that controlling the number, spacing, and width of pulses <u>within</u> a periodic signal of relatively long wavelength could be considered "varying the duty cycle" of a constant frequency signal.

Even assuming that changing the number, spacing, and width of the pulses -- i.e., selecting the waveform -- as disclosed by Saar falls within the meaning of varying the duty cycle of a constant frequency signal, claim 1 further requires that variation of

the duty cycle is in accordance with the position of an operator actuable switch, and thereby controlling the speed of the motor. Waveform selection is described by Saar at column 3, lines 58-62: "The microprocessor **24**, in response to either internal instructions or externally inputted instructions provided through, for example, a user input interface and/or condition responsive transducers, addresses a selected one of the p available pages within the memory 20...."

The examiner takes "official notice" (Final Rejection at 2-3) of the artisan's knowledge of power switches to adjust the speed of a motor, and mode selecting switches for high and low speed operation of a power tool. Saar, however, at column 6, line 53 through column 7, line 8 describes such switches. Considering the reference as a whole, we agree with appellant, as argued on pages 3 and 4 of the Reply Brief, that Saar does not disclose or suggest varying the duty cycle of the signal in accordance with the position of a switch to control the speed of a motor. We find that Saar discloses varying the frequency of the signal in accordance with the position of a switch to thereby control the speed of the motor. See, for example, the flow chart disclosed in Figure 4 of the reference.[2]

[2] Saar also discloses, in Figure 5 and column 8, line 28 through column 9, line 5, selecting different waveforms for providing constant output torque. Whether the artisan might interpret this as "varying the duty cycle" of the constant frequency signal, and thereby controlling the speed of the motor, would be speculative. In any event, the method measures actual torque, and selects the waveform accordingly, rather than selecting the waveform "in accordance with the position" of an operator actuable switch.

In general, the preamble of an apparatus claim may be entitled to little patentable weight if the language merely sets out an intended field of use. However, an accepted principle in the interpretation of a Jepson-type claim is that the preamble represents actual scope of the claim, rather than mere field of use. Therefore, a rejection under 35 U.S.C. § 103, which is required to set out underlying factual findings as described by Graham v. John Deere Co., 383 U.S. 1, 17-18; 148 USPQ 459, 467 (1966), must show how the combination as a whole would have been rendered obvious by the prior art, including the limitations in the preamble of the claim. The claims are not directed merely to "improvements," but to improvements within the prior art structures set forth. That Saar might disclose that a "PWM d.c. control signal generated by [the] control circuit is less than 50 Hz" (claim 1) is not dispositive. The reference fails to disclose or suggest all the requirements of claim 1.[3]

We therefore cannot sustain the section 103 rejection of claim 1 over Saar. Nor can we sustain the rejection of claim 3, for substantially the same reasons. The claim requires modulating the power supplied to the motor "in accordance with the position of said [operator actuable] switch by varying the duty cycle of a constant frequency, pulse width modulated (PWM) direct current (d.c.) control signal generated by the control

[3] To rely on the implied admission rendered by the Jepson format, the proper ground of rejection would be under 35 U.S.C. § 103 as being unpatentable over appellants' admitted prior art in view of Saar. However, we find no motivation in the prior art before us for combining Saar's disclosure of a PWM signal with a power tool that controls the speed of the motor by varying the duty cycle of a constant frequency, PWM control signal, as described in the preamble of claim 1. Nor does the rejection of record supply any motivation for such combination.

circuit to thereby control the speed of the motor." At least this noted feature of the claim has not been shown as disclosed or suggested by the reference. Further, we cannot sustain the rejections of method claims 11 and 27, which contain limitations of similar scope to those we have addressed with respect to claims 1 and 3, although rather than an "operator actuable switch," variation of a duty cycle is in response to an "operator actuable device."

Finally, we cannot sustain the rejection of instant claim 7. The allocation of burdens requires that the USPTO produce the factual basis for its rejection of an application under 35 U.S.C. § § 102 and 103. In re Piasecki, 745 F.2d 1468, 1472, 223 USPQ 785, 788 (Fed. Cir. 1984) (citing In re Warner, 379 F.2d 1011, 1016, 154 USPQ 173, 177 (CCPA 1967)). The one who bears the initial burden of presenting a prima facie case of unpatentability is the examiner. In re Oetiker, 977 F.2d 1443, 1445, 24 USPQ2d 1443, 1444 (Fed. Cir. 1992). The rejection does not explain how Saar might be deemed to disclose or suggest all the limitations of claim 7 (see, e.g., Brief at 10); nor, for that matter, the further limitations in claims 3, 11, and 27 appellant points out in arguments in the Reply Brief.

Having not sustained the rejection of any of the independent claims (1, 3, 7, 11, 27) over the single reference applied, we thus do not sustain the section 103 rejection of claims 1-8, 11, 12, and 21-30 as being unpatentable over Saar.

CONCLUSION

The rejection of claims 1-8, 11, 12, and 21-30 is reversed.

REVERSED

Parshotam S Lall
PARSHOTAM S. LALL
Administrative Patent Judge

STUART S. LEVY
Administrative Patent Judge

HOWARD B. BLANKENSHIP
Administrative Patent Judge

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